EPA/ROD/R05-93/243
1993

EPA Superfund
Record of Decision:

OTT/STORY/CORDOVA CHEMICAL CO.
EPA ID: MID060174240
OU 03
DALTON TOWNSHIP, MI
09/27/1993

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial threat topublic health, welfare, or the environment.

Description of the Selected Remedy

This remedy is the third of three operable units selected for the Ott/Story/Cordova site and consists of a remedy for the contaminated soils and sediments. The remedy is viewed as consistent with the previous two remedies selected for this site. The primary goals of this selected remedial action at the Ott/Story/Cordova site are to reduce infiltration into contaminated soils which may add to the burden of groundwater contamination to be dealt with by Operable Units One and Two and to reduce the health and environmental risks associated with exposure to such contaminated materials.

The Ott/Story/Cordova Operable Unit Three field work, which was conducted in 1992, supplements the Remedial Investigation of 1988-1989. The major components of the selected remedy consist of excavation of contaminated soils/sediments, treatment of such materials utilizing the technique of low temperature thermal desorption, on-site backfilling of those treated soils which successfully attain pertinent soil cleanup criteria, and off-site disposal of that portion of treated soils which do not attain cleanup criteria. Emissions created from contaminants driven off the soils by this treatment technique would be controlled as necessary through utilization of such techniques as flaring of vapors thus generated, routing such vapors through carbon adsorbents, and/or collection and subsequent treatment of vapor condensate. Monitoring will be necessary to ensure that cleanup criteria are attained.

Declaration of Statutory Determinations

The selected remedy is protective of human health and the environment, and is cost effective. The selected alternative will comply with all Applicable or Relevant and Appropriate Requirements (ARARs). The remedy utilizes permanent solutions treatment technologies to the maximum extent practicable. There may be some contaminated sediments left on or near the Little Bear Creek portion of the site; future monitoring will determine if such sediments require remediation after the construction of extraction wells and treatment facilities designed to serve the goals and objectives of Operable Units One and Two.

As required by SARA, when hazardous substances are left on site, a review will be conducted within five years after commencement of remedial action to ensure that the remedies continue to provide adequate protection of human health and the environment.

DECISION SUMMARY FOR THE RECORD OF DECISION

1. SITE NAME, LOCATION, AND DESCRIPTION

The Ott/Story/Cordova Superfund site consists in part of a former chemical production site located at the end of Agard Road in Dalton Township, Michigan, five miles north of the City of Muskegon. The former production area is approximately 20 acres in size, and is surrounded by wooded land. Houses are located to the west of the site along Whitehall Road, and a mobile home park is located about a quarter of a mile northwest of the facility. Residential areas are also located in close proximity to the former production areas along Central, River, and Russell Roads. These residential areas are considered as part of the facility. About one-half mile east of the former production areas, Little Bear Creek and an unnamed tributary of the creek flow south, joining near River Road, to the southeast. Little Bear Creek flows into Bear Creek, which empties into Bear Lake. Bear Lake eventually flows into Muskegon Lake, and then into Lake Michigan. See the diagram denoted as "Vicinity Map" for an approximate depiction of site setting.

2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

Since the 1950s, various sets of parent corporations, divisions, and subsidiaries have owned and/or operated chemical plants on the site. The names of the previous and present owners most likely familiar to the public are Ott Chemical Company, Story Chemical Company, and Cordova Chemical Company. The chemical plants used various raw materials to manufacture pharmaceutical intermediates, veterinary medicines, agricultural chemicals, herbicides, dyestuffs, and other products. For a significant portion of the site's operating history, waste by-products from the chemical manufacturing processes were placed in unlined lagoons or stored in drums on the property.

As early as 1959, groundwater problems began to be noted at the site. At that time, an on-site water supply well used by Ott Chemical became fouled, due in part to the spread of contaminants that had entered the aquifer after seepage from the lagoons. The act of seeking new water supplies, and abandoning former supply wells was repeated by site operators several times during the site's history.

Later, in response to State of Michigan concerns, efforts were made by the site owners to slow the spread of the groundwater contaminant plume. By the mid 1960s, a program of purging certain portions of the aquifer was begun, and by 1968 an effort was made to segregate particularly high-strength organic waste from more dilute process and cooling flows.

Lagoon utilization for lower strength process and cooling flows continued for a time. Plant documentation indicates that due to spills and other mishaps, the conceived plan of only less-concentrated waters reaching the lagoons did not always occur. By the 1970s, lagoon usage on a day-to-day basis began to give way to usage for cooling water only, as measures to help protect the integrity of water supply wells needed for facility operation.

Neutralization and flow equalization basins were installed about 1968-69. The purpose of the latter devices appears to have been for primary treatment of process wastewater flows routed thereto. Certain plant wastewaters were highly acidic or basic; hence the role of the neutralization basin.

In the mid-1960s, untreated groundwaters and process flows were directed to Little Bear Creek for discharge. Correspondence by representatives of the Michigan Water Resources Commission and later the Michigan Department of Natural Resources (MDNR) expressed concern as to the effectiveness of such efforts. Several instances of exceedances of allowable discharge limitations to the receiving stream as established by the State of Michigan occurred from time to time. Citizen complaints and concerns of the State of Michigan resulted in the construction of a pipeline in the later 1960s to reroute wastewaters to the Muskegon River. At that time, analysis of the wastewaters centered on conventional parameters such as solids, pH, phenol content, and BOD/COD. In an effort to help gauge possible biological effects, fish taint tests were also conducted from the mid to late 1960s to the early 1970s. This consisted of a panel of plant personnel comparing the flavor of control trout to those exposed to the plant effluent. By about 1973 or 1974, the plant extended the pipe line to the Muskegon County Publicly Operated Treatment Works (POTW). Production wastewater discharges from the site to the POTW via the pipeline continued until 1985. (It may be of interest to the reader to note that in recent years, and reinforced by a 1992 vote of the County Public Works Board, Muskegon County has adopted a strict policy of refraining from accepting a discharge which originated from contaminated groundwater within the County.)

In an effort to reduce the volume of wastes accumulating on site, an incinerator was installed on the site by the late 1960s to treat more concentrated industrial wastes. Plant documentation indicates that this unit experienced considerable downtime, plus there were instances when this and other plant equipment actually exploded. During such downtimes, wastes were stored in drums. While some effort was made to reduce this backlog, the net effect was that drums of waste accumulated on site in the 1970s. Testimony of past plant operators indicated that some open land areas of the site were used for waste and drum disposal.

By 1977, with the then present site owner (Story Chemical) in bankruptcy, a removal action was undertaken by the Michigan Department of Natural Resources (MDNR) and financed in part by a new site owner. Several thousand drums and thousands of cubic yards of lagoon sludges were removed and disposed of from the site. It appears that even though lagoon usage as a day to day measure of handling plant process flows declined over time, the sludges in the lagoons were not removed until several years later.

During the site's history, various information and documents were filed with federal and state governments. Briefly, and in approximate chronological order, these are:

- Information generated by Ott Chemical regarding Michigan Orders of Determination concerning groundwater and lagoon usage (approximately 1965-1966).

- Information generated by Ott and Story Chemical concerning effluent content to waters of the State of Michigan (approximately 1967-1973).

- Information generated by Ott Chemical and submitted to the Corps of Engineers regarding the River and Harbors Act, (a forerunner of the National Pollutant Discharge Elimination System) (approximately 1971).

- Filing for generator status and treatment/storage permits by Cordova Chemical of Michigan under the Resource Conservation and Recovery Act (approximately 1980).

- Filing by Cordova Chemical for various Michigan air permits(early 1980s).

By at least the mid 1970s, contamination of off-site residential wells downgradient of the plant was noted. For a time, the county and state helped to assist local residents by providing a supply of bottled water, and through increased monitoring efforts of potentially affected wells.

In 1981, the MDNR referred the Ott/Story/Cordova site to U.S. EPA for inclusion in the newly established Superfund program. In 1982, the site was placed on the National Priorities List (NPL). Also in 1982, an alternate water supply was installed in the vicinity of the site as settlement of a citizens' suit against some former site owners, and financed in part by a former site owner, and in part by the State of Michigan.

Distinct sets of site owner/operators have been involved in the site during its history. The Ott Chemical Company began operations at the site in the 1950s as an independent company. In 1965, Corn Products Company, now CPC International, Inc., purchased all stock of Ott Chemical. In 1972, CPC sold assets that comprised the Ott Chemical operations to Story Chemical. In late 1976-early 1977, Story Chemical initiated bankruptcy proceedings. In late 1977-early 1978, Cordova Chemical Company of Michigan purchased the site after entering into an agreement with the State of Michigan. The agreement called for Cordova to destroy or neutralize phosgene gas left at the site, and to finance in part the State's action to remove drums of waste and lagoon sludge. U.S. EPA was not a party to the agreement.

In 1985, U.S. EPA sent a notice letter to Cordova and CPC, which advised them of their potential liability under CERCLA for cleanup of the site. The letter offered them an opportunity to conduct a site Remedial Investigation/Feasibility Study (RI/FS). Both CPC and Cordova declined this offer, and U.S. EPA conducted an RI/FS. In March 1989, U.S. EPA sent demand letters for cost recovery to CPC and Cordova. In May 1989, U.S. EPA also informed Cordova Chemical Company of California (Cordova CAL), parent company of Cordova-MI, AerojetGeneral (parent company of Cordova of California) and Swanton-Story Corporation (successor of Story Chemical) of their potential liability with regards to this site and sent demand letters to these firms.

In August 1989, pursuant to a Section 122(a) letter, AerojetGeneral, Cordova CAL, Cordova-MI, and CPC International were given notice that U.S. EPA had determined that a period of negotiations would not facilitate an agreement for remedial design and action for Operable Unit One. The availability of the Proposed Plan/Focused Feasibility Study, and notice of the start of a public comment period were also stated in the letter.

Litigation among the various private parties, the State of Michigan, and U.S. EPA began in the summer and fall of 1989 with the filing in federal district court of various suits concerning claims for reimbursement and allegations of liability for actions taken and environmental conditions at the site. Following the discovery phase of the litigation, a trial concerning the issue of liability of the PRPs and the State of Michigan commenced in the U.S. District Court in Grand Rapids, Michigan. Although U.S. EPA had not named the MDNR or the State of Michigan as a PRP, Aerojet- General and CPC asked the Court to declare Michigan as liable on the theory of having arranged for disposal of hazardous substances. Prior to the commencement of trial, the U.S. EPA had reached a tentative settlement agreement with Dr. Arnold Ott for past response costs. A Consent Decree memorializing such settlement has been entered by the Court, and the terms of this Decree have been met. Trial was conducted from early May to middle of June 1991. A verdict was reached concerning liability on August 27, 1991. The Court found Aerojet-General Corporation and Cordova-MI liable for response costs under CERCLA section 107(a)(1). Additionally, the Court found these persons, plus CPC International Inc., and Cordova CAL liable under CERCLA section 107(a)(2). MDNR was found not liable under any part of CERCLA section 107.

CPC, Aerojet and the U.S. Government, after the findings of liability, entered into a stipulated settlement over the amount of federal response costs owed through June 1990, subject to an appeal of liability. On September 10, 1992 the Court entered judgement for this amount and also entered a declaratory judgement that the Aerojet defendants and CPC are liable for future response costs incurred by the government. Aerojet and CPC have appealed the district Court's judgement to the Sixth Circuit Court of Appeals. Briefs have now been filed with the Court of Appeals.

U.S. EPA also notes that litigation is currently proceeding in the state courts of Michigan between Aerojet and the State of Michigan. A lower court has found that Michigan breached the afore-mentioned contract. This decision is being appealed by the State of Michigan.

U.S. EPA began field work for the Remedial Investigation (RI) in January 1988. The report discussing this investigation was completed in April 1989, supplemented in 1990, with further information on site soils/sediments becoming available in 1992. In August 1989, U.S. EPA initiated a public comment period concerning the Proposed Plan for the first operable unit, which dealt with preventing further groundwater contamination from entering Little Bear Creek. Upon consideration of comments made, U.S. EPA developed a Record of Decision for the first operable unit in September 1989. U.S. EPA reopened the public comment period from November to December 1989, and based upon review of comments received affirmed its initial decision in March 1990. In May 1990, U.S. EPA obligated federal dollars to initiate the Remedial Design for the first operable unit.

The Feasibility Study (FS) for the site was completed in early summer 1990. In July 1990, U.S. EPA began a public comment period for a second operable unit for the site, which considered the matter of aquifer restoration. In response to a request from one party, U.S. EPA extended the comment period into September 1990. After evaluation of public comment and response to significant comment, U.S. EPA selected a remedy which, through extraction and treatment of contaminated groundwater, would be designed to restore the contaminated aquifer. In October 1990, PRPs were informed by U.S. EPA that the Agency could not make a determination that a period of negotiation would facilitate settlement between those persons and the Agency, but that U.S. EPA would consider PRP response which might allow the making of such determination. No responses were received which caused U.S. EPA to make such determination. In the first quarter of calendar year 1991, U.S. EPA obligated funds for remedial design of the second operable unit. In 1992, U.S. EPA and MDNR obligated remedial action funds, and in March 1993 the U.S. Army Corps of Engineers solicited construction bids. Bids were opened in July 1993, and a contract awarded in September 1993.

During the RI, U.S. EPA found elevated levels of numerous organic compounds in soils and groundwater at and downgradient of the site. As noted previously, U.S. EPA has developed two Records of Decision (ROD) for the site which deal with halting surface-water contamination at the site, and with groundwater restoration efforts, respectively.

3. HIGHLIGHTS OF COMMUNITY PARTICIPATION

An RI/FS "kickoff" availability session was held near the site in November 1987. Upon completion of the RI in April 1989, a copy of the RI report was made available to the public at the information repositories maintained at the Dalton Township Public Hall and the Walker Memorial Library in North Muskegon. The RI was also made a part of the administrative record file maintained in Region 5 and at the local repository at the Walker Memorial Library. A Proposed Plan and Focused Feasibility Study for Operable Unit One, which dealt with the contamination of Little Bear Creek and its unnamed tributary, were released to the public on August 1, 1989 to initiate a public comment period for the proposed action. A public meeting was held in August 1989. U.S. EPA extended the comment period into September 1989. Upon consideration of comments made, U.S. EPA developed a ROD for the first operable unit in September 1989. U.S. EPA reopened the public comment period from November to December 1989, and based upon review of comments received affirmed its initial decision in March 1990.

The Feasibility Study (FS) and Proposed Plan for Operable Unit Two were made available to the public in July 1990. A notice of availability was published in the Muskegon Chronicle on July 24, 1990 to initiate a public comment period on the alternatives from July 25, 1990 to August 23, 1990. In addition, a public meeting was held on August 16, 1990 in Muskegon County. In response to a request for extension, U.S. EPA subsequently extended the public comment period to September 24, 1990. After evaluation of public comment and response to significant comment, U.S. EPA selected a remedy which, through extraction and treatment of contaminated groundwater, is designed to restore the contaminated aquifer.

In December 1991, U.S. EPA conducted an informal public meeting at the Dalton Township Hall to discuss with interested citizens what appeared at that time to be the leading treatment concepts for contaminated groundwater in the remedial design, and the objectives of sampling envisioned for the third operable unit. MDNR also participated, and discussed design questions and explained the goals and objectives of pump testing proposed by private parties.

On April 5, 1993, U.S. EPA released a supplement to the FS and a Proposed Plan for Operable Unit Three to the public. A notice of the availability of these documents was placed in the Muskegon Chronicle on March 31, 1993 to initiate a public comment period on the alternatives from April 5, 1993 to May 4, 1993. In addition, a public meeting was held on April 20, 1993 in Dalton Township, Muskegon County. At this meeting, representatives from U.S. EPA and the MDNR answered questions concerning site conditions and remedial alternatives under consideration. A court reporter was present to record oral comments. Written comments were also solicited at the hearing. The public was reminded that anyone desiring additional information about the Superfund process or the activities to be conducted by U.S. EPA at the Ott/Story/Cordova site can review the documents that have been prepared for the site. The location of such documents was noted. In response to a request for extension, U.S. EPA subsequently extended the public comment period to June 3, 1993. In response to a further request for extension of the public comment period received by U.S. EPA on May 27, 1993, U.S. EPA subsequently extended the public comment period to July 6, 1993.

A response to the comments received during this period is included in the Responsiveness Summary, which is part of this ROD. This decision document presents the selected remedial action for Operable Unit Three for the Ott/Story/Cordova Site in North Muskegon, Michigan, chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the National Contingency Plan (NCP). The decision for this site is based on the administrative record.

4. SCOPE AND ROLE OF OPERABLE UNIT

As with many Superfund sites, the problems at the Ott/Story/Cordova site are complex. Consequently, U.S. EPA organized the remedial work into three planned operable units at the site. This ROD addresses the third operable unit planned for the site. As noted within the NCP, total site remediation is the desired objective. However, as the NCP states, often it is necessary and appropriate, particularly when dealing with complex sites, to divide the site into remedial categories for effective management. The RI developed for the Ott/Story/Cordova site indicated the presence of a wide variety of hazardous substances in groundwater, surface water, soils, and sediments. Therefore, U.S. EPA divided the site into three operable units (OU) as follows:

- OU One: Considers surface water degradation of Little Bear Creek due to the influx of a portion of the contaminated groundwater caused by past disposal practices at the site.

- OU Two: Considers site groundwater and aquifer quality restoration.

- OU Three: Considers whether certain areas of site surface and near surface soils and sediments should undergo remediation.

U.S. EPA has already selected the cleanup remedy for OU One and Two. Entry of contaminated groundwater into the Little Bear Creek system constituted a threat at the site because of the resultant degradation of a portion of the creek system. Therefore, OU One seeks to intercept contaminated groundwater before it enters the creek system, and to provide treatment for waters thus collected.

The capture and treatment of all known contaminated groundwater below and downgradient of the site, and the matter of attempting to attain pertinent federal and state regulations concerning groundwater were addressed by OU Two.

OU Three will address residual areas of contaminated soils and sediments at the site. U.S. EPA believes, in keeping with the NCP, that the selection and execution of a remedy for OU Three will be neither inconsistent with nor preclude the implementation of other remedies selected for the site.

In this third and final planned operable unit for the site, U.S. EPA considers the matter of contaminated soil areas at the Ott/Story/Cordova site. In 1992, U.S. EPA completed a Field Investigation Memorandum concerning results of recent sampling activity, updated risk calculations to account for the recent sampling activity, and supplemented the FS for the Ott/Story/Cordova site. This information helped U.S. EPA assess the potential impacts on remedial alternatives of certain requirements under the federal Resource Conservation and Recovery Act (RCRA) and the Michigan Act No. 307 which were effective in the spring and summer of 1990, respectively. Under RCRA, new regulations involving Toxicity Characteristic Leaching Procedure (TCLP) became effective. Approximately 25 organic compounds were added to a list of compounds that could classify a waste as hazardous dependent on the leaching potential of such compounds from that waste. The TCLP test now includes such compounds as hexachlorobenzene, methoxychlor, and 1,4- dichlorobenzene which are compounds previously found in certain site soil samples during U.S. EPA's Remedial Investigation (RI) of the site. U.S. EPA has also considered past acts of disposal conducted at the site, and whether such acts may involve disposal of certain listed wastes as discussed within Part 261 of RCRA. Under Act 307, rules were enacted specifying how cleanup criteria may be applied to a site. The volume of soils to be managed have been revised somewhat from earlier FS estimates based on these new enactments, as well as field findings from sampling conducted at the site in winter 1992.

During the trial on liability issues, several former employees appeared as witnesses before the Court and discussed their recollections of past disposal activity at the site. In planning for Operable Unit Three sampling activity, U.S. EPA met some of these persons at the site and exchanged correspondence with others in an effort to better locate possible areas subject to disposal activity. In January and February 1992, U.S. EPA performed the field sampling for Operable Unit Three investigative purposes. U.S. EPA excavated and made visual examinations in certain areas of the Site in order to check areas of unusual geophysical characteristics and points brought to the Agency's attention by past plant operators. The inspections revealed that some site areas were formerly used as places of waste disposal. An area east of the former production facilities and located in a field south of the equalization basin, in particular, was found through these visual inspections to contain hazardous substances and disposed drum fragments.

U.S. EPA also collected a select number of soil samples near locations where past waste incineration or other burning may have been conducted. U.S. EPA learned during the course of recent site investigations and through review of plant operator testimony at trial that the former incinerator had been subject to certain process upsets, and that combustion efficiency of past burning operations may have been low.

U.S. EPA also arranged for the collection of soil samples near areas of sparse vegetation at the site, and through its Corvallis, Oregon Research Laboratory conducted biological screening of such samples to see if, compared to background conditions, such soils pose an environmental threat due to past releases of raw materials, intermediates, or products utilized at the site.

Results of these sampling efforts were received by U.S. EPA in 1992, and subsequently placed in the administrative record file, as well as pictures of the field investigation efforts.

Volumes of soils estimated to be dealt with have also been modified somewhat based on the outcome of further exploration of surface and shallow subsurface soil areas. The areas explored were those noted by plant operator personnel in court testimony presented in May 1991 and areas of unusual geophysical characteristics found by U.S. EPA.

5. SUMMARY OF SITE CHARACTERISTICS

An important site characteristic at Ott/Story/Cordova is the sandy nature of site soils which have a high permeability. Although there is likely some seasonal variation, the groundwater is encountered only about five feet below the ground surface of the site. Past usage of unlined waste lagoons and subsequent plant spills/releases through vessel overfill, container failure, pump failure, improper valve function, product line blockage, etc., have resulted in introduction of pollutants into the soil and groundwater.

The site is at the headwaters of a very small surface water and likely groundwater divide. Drainage is generally to the southeast. It should be noted that at the extreme western end of the site, toward Whitehall Road, surface drainage patterns likely shift to the Green Creek basin. U.S. EPA is not aware to date that Site releases have affected this stream as opposed to the Little Bear Creek basin. Monitoring wells to be placed near the site as part of Operable Unit One and Two remedial action will help provide further information whether contaminated groundwaters have migrated or could migrate beyond the Little Bear Creek basin.

Down to about the 65 foot depth, soils are predominantly sandy. The aquifer in this zone is unconfined. From about 65'-85' below the ground's surface, there are layers of silts and clays, which tend to subdivide the upper sandy zone from the lower sandy zone which predominates again below the 100' depth until a thick clay zone is encountered at about 150'. Information from a pump test conducted by consultants for the responsible parties in the winter of 1992 indicated that the silt/clay layers allowed leakage between deeper and intermediate aquifer zones. Some borings performed during this test, which was near the intersection of River and Central Roads, indicated some signs of soil staining and chemical odors at approximately the 90' depth.

In the context of Operable Unit Three, the term "subsurface soil" includes only those areas that are at or above the groundwater table. As discussed in the 1989 RI Report, a contaminant's characteristics such as structure, solubility, and vapor pressure influence its potential to migrate and its rate of migration in oils and groundwater.

Background sample collection in the area of the facility in 1988 revealed negligible levels of organic contamination in soils, sediments, and surface waters. These conditions held true in 1992 also.

Highlights of field results for Operable Unit Three sampling are presented below. Results are presented in terms of micrograms per liter for water samples, and in terms of micrograms per kilogram for soil or sediment samples. Such units correspond roughly to parts per billion. Figures 1 and 2 provide a depiction of some of the key sampling points utilized in the 1992 supplement to the FS field work. Tentatively identified compounds and their estimated concentrations are indicated by "*."

1992 Supplemental Sampling Results

Sample Location/Type	Contaminant	Concentration
SW 3(water)	Benzene	6000
	Toluene	4800
	4-Chloroaniline	1000
	- various alkyl benzeneamines	1100
SD 3(sediment soil)	Benzene	17000
	Toluene	42000
	4-Chloroaniline	1200
	4-Methylphenol	1000
	- congeners of dimethyl benzenamine	22000
	- congeners of ethyl benzenamine	22000
SD 4(sediment soil)	Benzene	17000

	Toluene	99000
	- congeners of ethyl benzenamine	12000
SW 4(water)	Benzene	4500
	Toluene	6400
	Chloroethane	1000
	4-Chloroaniline	2300
	- various alkyl benzeneamines	3600
TP 3A(test pit soil)	Arochlor-1254	3900
TP 3B(test pit soil)	Hexachlorobenzene	1600
	Lead	102000
TP 5A(test pit soil)	Chloroform	1600
	1,2 - Dichloroethane	3400
	Carbon Tetrachloride	26000
	1,1,2 - Trichloroethane	3100
	Tetrachloroethene	2300
	4-Chloroaniline	1200
	Lead	91700
	- benzamide	15000
	- 1-chloro-2-isocyano-benzene benzene	2600
TP 5B(test pit soil)	- Trifluralin	6700
SS 2(surface soil)	2,3,7,8- Tetra- chloro- dibenzo-1, 4-dioxin (estimated value)	0.02
SS 3(surface soil)	Arochlor-1248	5800
	Lead	16800
	- 2,6-Dichlorobenzamide	19000
	- 2,6-Dichlorobenzo-nitrile	33000
SS 5(surface soil)	- 2,6-Dichlorobenzo-nitrile	17000
SS 7(surface soil)	4-Chloroaniline	1700
	Hexachlorobenzene	1300
	Lead	28300
	Chromium	21600

Highlights of 1988 Remedial Investigation Results for Soils

Sample Location/Type	Contaminant	Concentration
SF-01SW(surface soil)	4-Nitroaniline	2300
SF-01SE(surface soil)	4-Nitroaniline	2700
SF-01NE(surface soil)	4-Nitroaniline	2400
SF-02W(surface soil)	4,4'-DDT	25000

SF-02E(surface soil)	4,4'-DDT	1900
SF-05S(surface soil)	4,4'-DDT	4200
SF-05N(surface soil)	4,4'-DDT	5900
	Methoxychlor	5300
SF-06(surface soil)	4-Chloroaniline	1200
SF-09(surface soil)	Aroclor-1248	15000
SF-10SW(surface soil)	Hexachlorobenzene	3400
SF-10NW(surface soil)	Methoxychlor	1300
SF-11W(surface soil)	4,4'-DDT	5500
SF-11E(surface soil)	4,4'-DDT	5400
SF-12M(surface soil)	4,4'-DDT	2700
	Methoxychlor	8400
SB-07(near surface soil in close proximity to SF-12)	1,1,1-Trichloroethane	17000
	Xylene(s)	79000
SF-16(surface soil)	Benzoic Acid	2900
	Hexachlorobenzene	1300
	4,4'-DDT	1200
SB-24(near surface soil in close proximity to SF-16)	1,4-Dichlorobenzene	7600
	1,2-Dichlorobenzene	13000
	Hexachlorobenzene	7800
SF-20(surface soil)	1,2-Dichlorobenzene	11000
	Benzoic Acid	75000
	Methoxychlor	25000

A look at this information indicates that in general, aside from the areas subject to waste disposal activity, soil contamination tends to predominate in those areas of the plant where raw materials/products were shipped in and out of the plant, or where internal routing of wastewaters took place.

The TCLP testing conducted at the site by U.S. EPA indicated that the contaminated soils/sediments were not characteristically hazardous waste with regard to such compounds as methoxychlor, hexachlorobenzene, and 1,4-dichlorobenzene. TCLP testing conducted by certain private persons indicated that one soil sample may be characteristically hazardous for the compound carbon tetrachloride.

U.S. EPA also performed limited biological testing on certain site soil samples to explore possible environmental damage consequences. Biological testing consisted of the standard vegetative root elongation toxicity test and "Microtox" testing. Microtox is a commercially produced bacterium used for toxicity testing which is luminescent. If its metabolic processes are inhibited such as by being exposed to toxic media, its luminescence decreases proportionately with relative luminescence thereby providing a measure of toxicity. These tests were conducted on four soil samples collected from the site. One of these points was from beyond the fenceline northwest of the former production area, and was collected for background purposes. No indications of toxicity were revealed for this sample. Of the other three samples, two were collected in the vicinity of the former pilot plant area, and one from an area south of Agard Road believed to have been used for fire training purposes. Notably in the vicinity of the pilot plant, there were indications of significant toxicity with regard to both the root elongation and Microtox test. Dioxin sampling in the vicinity of the former incinerator pad indicated positively the presence of dioxins, although at a level below quantifiable detection limits.

Soil/Sediment Cleanup Criteria

U.S. EPA indicated in its April 1993 Proposed Plan for this site that, in this situation, it appears appropriate to conduct any necessary site soils/sediment cleanup to attain Michigan Act 307 Type B soils criteria. These criteria are listed on the next page for contaminants of concern at the Ott/Story/Cordova site. It should be noted that Type B criteria take into account the potential for contaminants in soil to contaminate groundwater, and health risk from direct contact with contaminated soils. The potential to contaminate groundwater is based on a level of 20 times the corresponding groundwater criterion for a given contaminant. The selected Type B cleanup level is then based on the more restrictive of these two values. However, in some cases one of the values calculated may fall below analytical detection limits for a given compound, in which case the analytical detection limit becomes the cleanup criterion. In developing these criteria, calculations by U.S. EPA contractors underwent review by MDNR staff. It would be appropriate to invoke these criteria if an examination of potential risk to human health or the environment at the site revealed an unacceptable degree of risk posed by the site soil/sediment conditions.

Soil Cleanup Criteria

Contaminant	Type B Cleanup Criterion in parts per billion[*]
Aldrin	1.7
Aroclor- 1248 (PCB)	1000
Bis (2-ethyl hexyl) Phthalate	60
Butyl Benzyl Phthalate	22000
Chlorobenzene	2600
4,4-DDT	2
1,2-Dichloroethane	8
1,2-Dichlorobenzene	12000
1,4-Dichlorobenzene	30
Dieldrin	0.04 (to detection limit)
Ethyl Benzene	1500
Endosulfan Sulfate	3.3
Hexachlorobenzene	0.4
Methylene Chloride	92
Methoxychlor	700
1,1,2,2-Tetrachloroethane	3.6
Tetrachloroethene	14
1,1,1-Trichloroethane	4000
1,1,2-Trichloroethane	13
Trichloroethene	44
1,2,4-Trichlorobenzene	2200
Toluene	16000
Xylene	5600

6. SUMMARY OF SITE RISKS

The purpose of risk assessment is to estimate the magnitude of potential risk to public health and the environment which may be due to exposure to contaminants identified at the site. Such assessment involves identifying contaminants of potential concern, routes by which such contaminants may migrate, and populations which may come into contact with the contaminants. Furthermore, the assessment is based on the premise that no action will be taken at the site to remediate areas of contamination. The assessment may also consider current site conditions, and possible future land use changes.

Factors in selecting contaminants of concern include whether a given substance was found at levels above background, the degree of occurrence for the substance, and the relative toxicity of a compound. For estimates of human health risk, the general types of toxicity may be subdivided into the two major categories of carcinogenic and noncarcinogenic effects. As used within the context of a site risk evaluation, the term noncarcinogenic refers to deleterious health effects other than cancer which may be caused by exposure to a given substance; carcinogenic refers to a substance or agent which produces or incites cancer.

Contaminated soils, sediments, and water may create pathways for exposure to such chemicals through dermal contact, ingestion, or inhalation.

With regard to Operable Unit Three, the pathways of exposure of primary concern involving soils/sediments are exposure to site workers, and future exposure to soils and sediments should residential usage of the site occur. Future workers may include construction and/or maintenance workers performing most of their activity outside, as well as general workers who may work both inside and out of doors. The routes of exposure would include dermal absorption for contaminated soil particles adhering to the skin, ingestion of soil particles, and inhalation of materials which may volatilize from soils/sediments into the air.

Different categories of site users or workers may have varying degrees of exposure to site contaminants. Factors which may affect degree of exposure include the amount of incidental ingestion of soil and dust, the number of times a worker or visitor may come to the site in a given length of time, the type of activity engaged in by an individual, the weight of the individual, the degree to which a substance may be absorbed through the skin, etc. U.S. EPA makes note of certain standard default exposure factors listed in a March 25, 1991 directive from its Office of Solid Waste and Emergency Response on these topics. Using the information in this directive, as well as professional judgement, certain assumptions are made concerning individuals who may utilize the site now and in the future:

General Workers:
Incidental soil ingestion of 50 milligrams/day (directive) 250 days/year of exposure during a working career of 25 years (directive) Body weight of 70 kilograms (directive) Exposure to surface soils only with no access restriction (judgement)

Construction Workers:
Incidental soil ingestion of 480 milligrams/day (directive) 250 days/year of exposure during a working career of 1 year for a given project (directive) Body weight of 70 kilograms (directive) Exposure to both subsurface and surface soils in former central plant areas (judgement)

Maintenance Workers:
Incidental soil ingestion of 480 milligrams/day 50% of working day; otherwise 50 milligrams/day 250 days/year of exposure during a working career of 25 years (judgement) Body weight of 70 kilograms (directive) Exposure to both subsurface and surface soils in former central plant areas (judgement)

Future Site Residents:
Incidental soil ingestion of 100 milligrams/day for all persons above the age of 6 (directive) Incidental soil ingestion of 200 milligrams/day for persons up to the age of 6 (directive) 350 visits/year (directive) Body weight of 70 kilograms for adults (directive) Body weight of 15 kilograms for children (directive) Exposure to surface soils only (judgement)

Data sets were evaluated to consider those chemicals above background levels, toxicity constants for noncarcinogens and carcinogens were reviewed, and the degree of occurrence of a given substance at the site was considered.

EXPOSURE ASSESSMENT

Historically, during production periods at the site, non-regulated releases of contaminants occurred to the air, soil and water. Contaminants in soils at the site have a pathway for potential exposure to humans by either direct contact or use of groundwater. Allowable rates of release to waterways were established through state Orders; the history of the site indicates that several instances of exceedance of such allowable discharge rates occurred.

Further releases and migration of the contaminants can occur by movement of contaminants into groundwater with potential exposure pathways by means of production wells, subsequent discharge to surface water of at least a portion of the contaminated groundwater, volatilization into the air or suspension of contaminated dusts into the air, or runoff of surface water that may carry contaminated soils. RODs developed for Operable Units One and Two addressed risk and exposure from contaminants in the surface water and groundwater, respectively.

The presence of contaminants in soils and sediments result in several exposure pathways. Persons who may come in contact with soils/sediments are considered a potentially exposed population. Operable Unit Three will address the primary exposure scenario posed by contaminated surface and near surface soils and sediments. This scenario focuses on ingestion and dermal contact by potential site users. Volatilization of some substances from soils into the air is also possible.

TOXICITY ASSESSMENT

The degree of toxicity which may be posed by a given chemical may be described in part by its acceptable intake or its reference dose and in the case of carcinogens by its carcinogenic potency factor (CPF). Reference doses, or RfDs, are derived from information available from studies on animals or human epidemiologic studies. Adjustments from animal studies to predicted behavior with humans is subject to multiplication by various uncertainty factors. These values are normally reported in mg/kg body weight/day, and generally represent the highest calculated exposure level below which the given adverse effect will not occur. A carcinogenic potency factor is expressed as lifetime cancer risk per mg/kg body weight/day, and is estimated at the upper 95 percent confidence limit of the carcinogenic potency of a given chemical.

CPFs have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of (mg/kg-day)[-1], are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. CPFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to -human extrapolation and uncertainty factors have been applied.

RfDs have been developed by U.S. EPA to indicate the potential for adverse health effects from exposure to chemicals. The RfD is based on the assumption that thresholds exist for certain toxic effects such as cellular necrosis, but may not exist for other toxic effects such as carcinogenicity. In general, the RfD is an estimate with an uncertainty spanning perhaps an order of magnitude of a daily exposure to the human population. This includes sensitive subgroups that are likely to be without an appreciable risk of deleterious effects during a lifetime. RfDs can be derived for noncarcinogenic compounds, as well as for the noncarcinogenic health effects of compounds which are also carcinogens. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. Uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

The following information notes ingestion RfDs and CPFs for selected chemicals at the Ott/Story/Cordova site. (The term "E" refers to exponential notation, and for example in the case of "E-03" means to move the decimal point for the value given three places to the left.) Also noted is the weight of evidence for the various categories of potential carcinogens. The weight of evidence for carcinogenic behavior is divided into the following groups:

Group A chemicals, known human carcinogens, are agents for which there is sufficient evidence to support the causal association between exposure to the agents in humans and the on-set of cancer.

Group B1 and B2 chemicals, probable human carcinogens, are agents for which there is limited (B1) or inadequate (B2) evidence of carcinogenicity from human studies, but for which there is sufficient evidence of carcinogenicity from animal studies.

Group C chemicals, possible human carcinogens, are agents for which there is limited evidence of carcinogenicity in animals.

Group D chemicals, not classified, are agents with inadequate human and animal evidence of carcinogenicity or for which no data are available.

Group E chemicals are agents for which there is no evidence of carcinogenicity in adequately performed human or animal studies.

Hazardous Substance	RfD	Slope Factor	Weight of Evidence
1,1,2-trichloroethane	4.3E-03		
1,2-dichloroethane		9.1E-02	B2
Benzene		2.9E-02	A
Chloroform	1.0E-02	6.1E-03	B2
Tetrachloroethene	1.0E-02	5.1E-02	B2
Toluene	2.0E-01		D
1,2-dichlorobenzene	9.0E-02		D
1,4-dichlorobenzene		2.4E-02	C
4-chloroaniline	4.0E-03		
4-nitroaniline		3.0E-07	B2
Benzoic Acid	4.0E+00		
Benzo(a)pyrene		7.2E+00	B2
Hexachlorobenzene	8.0E-04	1.6E+00	B2
4,4'-DDT	5.0E-04	3.4E-01	B2
Aldrin	3.0E-05	1.7E+01	B2
Aroclor 1248		7.7E+00	B2
Methoxychlor	5.0E-03		
Dioxin		1.5E+05	B2
Lead			B2

RISK CHARACTERIZATION

Estimating the risk of a noncarcinogenic health effect isaccomplished by calculating the hazard quotient (HQ); this is done by dividing the dose estimated to be received by someone exposed to a substance by the established safe dosage estimate for that chemical. If the resulting answer is greater than 1 then the exposure has exceeded a safe level. Adding all the HQs for the chemicals of concern in a given route of exposure pathway gives a hazard index (HI) for that pathway. According to the NCP, when the HI exceeds 1, there is a potential health risk.

Carcinogenic risk is estimated by multiplying the estimated dose of the chemical by its published or calculated slope factor. As with noncarcinogenic hazard quotients, carcinogenic risks are assumed to be additive for all chemicals within an exposure pathway. The NCP has established a carcinogenic risk of greater than 1 x 10[-4] as being unacceptable for human health. (This represents the contracting of cancer due to environmental exposure as one in ten thousand.) The reduction of such risk to within the risk range of 1 x 10[-4] to 1 x 10[-6] is viewed by the NCP as acceptable; U.S. EPA often uses the 1 x 10[-6] figure as a desirable goal for adequate protection.

It may then be calculated under Risk Assessment Guidance for Superfund (1989 guidance to U.S. EPA) that risk for human populations may be expressed as follows:

Category	Noncarcinogenic (Hazard Index)	Carcinogenic (Excess Cancer Risk)

General Worker	0.3	1.18 x 10[4]
Construction Worker	0.46	3.0 x 10[-6]
Maintenance Worker	0.4	9.0 x 10[-5]
Future Site Visitor/ Resident	2.4 (HI of 1.9 age group 4-6; HI of 0.5 age group 7-30)	3.0 x 10[-4]
Current Visitor	0.02	2.0 x 10[-7]

(assumes exposure only to presently unrestricted site areas; surface soils only)

As can be seen from the scenarios reviewed above, risk associated with soils/sediments at the Ott/Story/Cordova site are above the threshold of acceptability for the general site worker, and threefold above this threshold for the case involving future residential usage. A special case is presented for soils in the vicinity of the former incinerator pad. At this point, dioxin compounds were detected. Because of the high slope factor utilized in calculations involving such compounds, exposure to surface soils at this point results in the following risk characterization for the site users noted on the previous page:

	Carcinogenic (Excess Cancer Risk)
General Worker	1.2 x 10[-3]
Construction Worker	9.1 x 10[-5]
Maintenance Worker	1.2 x 10[-3]
Future Site Visitor/Resident	7.3 x 10[-2]

Averaging of dioxin values across the site was not performed because the dioxin detected occurred only at the single point noted above.

Uncertainty associated with site risk concerns to what degree exposure parameter assumptions and land-usage patterns may change. For example, when remedial actions for Operable Unit One come on line fully, an improvement in stream water quality is the desired outcome. This factor may tend to promote stream usage; exposure to contaminated sediments may increase if sediment quality does not change as rapidly as water quality. Future land-usage patterns concerning former production areas and former administrative-type office areas are not certain.

Current and future risks to site users have the potential for over and underestimation. Should frequency or duration of exposure to future site users prove less than assumed, actual risk may be less than what is projected now. Current remedial action guidance emphasizes an examination of maximum expected risk, and not necessarily the worst possible case. Hence, the soils actually sampled do not likely reflect the worst case potentially presented. U.S. EPA has reason to believe, however, that more severe contaminant concentrations may exist on the site. For example, the contractor's log of test pit 5A as noted in the Field Investigation Memorandum speaks of a finding of a "... white & creamy sludge in a 2 ft. [by] 3ft. cavity in the bottom of pit w/lab bottles floating in it...", as well as "...black and purple staining..." elsewhere in the pit. Additionally, the tentatively identified compounds associated with both surface and subsurface sampling points may present some unknown risk to site users which are not now factored into these discussions. To illustrate this matter, 1992 sampling results indicate that there were 9300 ug/kg of tentatively identified semivolatile compounds associated with the background sampling location. This value may be contrasted with the finding of 329,000 ug/kg of tentatively identified semivolatile compounds associated with a sampling point northwest of the former pilot plant location, and 44,000 ug/kg of tentatively identified semivolatile compounds associated with a sampling point near the former plant's southern railroad spur. One compound tentatively identified at test pit sampling point 5B was Trifluralin. Page 9599 of the eleventh edition of

The Merck Index as published by Merck & Co., Inc., in 1989 informs the reader that Trifluralin is used as a pre-emergence herbicide. Tentative identification of chlorinated benzonitrile compounds occurred at surface soil sampling points SS03, SS04, and SS05. The reference source Sax's Dangerous Properties of IndustrialMaterials, by R. A. Lewis, eighth edition as published in 1992 by Van Nostrand Reinhold of New York provides safety profile information on these compounds. This text describes nitriles in general as organic compounds having the CN, or cyanide, grouping within the molecule. Chlorobenzonitrile is further characterized as moderately toxic by ingestion, and is considered an eye irritant. Upon contact with water, acid, or acid fumes, chlorobenzonitrile may release toxic fumes. This same reference source also discusses isocyanate compounds, and notes that organic isocyanates can cause irritation and allergic reactions. Organic compounds tentatively identified as having the isocyanate structure within the molecule were indicated at surface soil sampling points SS03, SS05, and test pits TP3B, TP5A, and TP5B. Azobenzene was tentatively identified at shallow soil boring SB03. The Condensed Chemical Dictionary, tenth edition, as published in 1981 by Van Rostrand Reinhold Company indicates that azobenzene is used in the manufacture of fumigants and acaricides, and that it is moderately toxic and may cause liver damage. Furthermore, some substances such as lead which were definitively identified and quantified do not have necessary toxicity information in the literature to perform risk calculations; hence risk may be underestimated for that reason.

Notably in the vicinity of the pilot plant there were indications of toxicity with regard to both the root elongation and the Microtox test. U.S. EPA interprets these test results as indicating that some past disposal practices may be having an adverse effect on the environment.

In summary, quantifiable risk to public health presented by soils/sediments at the Ott/Story/Cordova site are above upper limits as far as an acceptable degree of risk. Such calculations assume zero risk from tentatively identified compounds, and zero risk contribution from certain positively identified compounds for which no values exist in the literature to furtherquantify risk. U.S. EPA observes that it appears improbable that the true risk contributions of such compounds is zero. Furthermore, there is demonstration of environmental risk associated with such soils.

These results indicate that a potential ingestion or absorption of soils/sediments from certain areas at the Ott/Story/Cordova site pose significant health and environmental risks. The above discussions indicate that the risks from current and potential exposure to contaminated soils/sediments are unacceptable. Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

7. DESCRIPTION OF ALTERNATIVES

The alternatives analyzed for OU Three are presented below:

Alternative 1 - No Action

U.S. EPA is required to consider a no-action alternative. This alternative serves as a baseline for comparison purposes. Under this alternative, U.S. EPA would take no further action at the site to monitor, control, collect, treat, or otherwise cleanup contaminated soils/sediments. The cost of this alternative is therefore zero.

Alternative 2 - Institutional Control

Capital Cost: $ 54,000
Annual O & M Costs: $ 10,000/year for up to 30 years
Net Present Worth: $ 207,000
Time to Implement: 6 months

Access to some portions of the Ott/Story/Cordova site are restricted, notably by the fencing surrounding former production areas. Other portions of the site are unrestricted, and such areas include contaminated soil zones east and south of Agard Road. To further restrict public access to such areas, fencing could be extended/constructed and warning signs placed. Property deeds mayneed to be amended, so as to place restrictions on land use by current/future owners, precluding such persons from using certain land segments. No excavation or treatment of contaminated soil areas is envisioned.

Alternative 3a - Construction of an on-site landfill with subsequent excavation and disposal of contaminated soils/sediments therein, capping, monitoring, attain RCRA Subtitle D - Michigan Act 641, restriction of further land usage, security measures, maintenance of the landfill, clean fill

Capital Cost: $ 3,900,000
Annual O & M Costs: $ 50,000
Net Present Worth: $ 4,700,000
Time to Implement: 23-28 months

This alternative would involve the construction of an on-site landfill for the disposal of contaminated soils and sediments excavated from the site. Excavation will be conducted such that after disposal all other site areas will have either attained the cleanup criteria or the groundwater table will have been reached. The only exception to this excavation procedure would be in instances where obvious signs of past waste disposal activity are encountered at the groundwater table. Because of the relatively shallow groundwater table at the site, the landfill would be constructed above grade. It is estimated that approximately 7200 cubic yards of contaminated materials would undergo excavation. The landfill will be constructed to meet the requirements of Act 641, Michigan's solid waste regulations. Providing adequate cover over the contaminated soil and sediment would be at least two feet of clay, a drainage layer over the clay, a suitable geotextile membrane between the drainage layer and overlying soil of at least 1.5 feet in thickness, and finally topsoil and a vegetative cover to help minimize erosion. The design life of the landfill is estimated at 30 years.

Alternative 3b - Construction of an on-site landfill with subsequent excavation and disposal of contaminated soils/sediments therein, capping, monitoring, attain RCRA Subtitle C - Michigan Act 64, restriction of further land usage, security measures, maintenance of the landfill, clean fill

Capital Cost: $ 4,600,000 to 10,400,000
Annual O & M Costs: $ 50,000
Net Present Worth: $ 5,400,000 to 11,200,000
Time to Implement: 23-28 months

Alternative 3b differs from Alternative 3a in that a more rigorous manner of landfill structure design and capping is called for. Alternative 3b would be designed to manage excavated soils/sediments as though they were hazardous wastes. Alternative 3b presumes that the presence of numerous tentatively identified compounds, the wide variety of chemicals handled at the site during its history and the limited ability of routine analytical service to detect all such compounds, and the evidence that there may be more concentrated areas of contaminants on site than sampling results have thus far quantified should result in more conservative management of excavated soils than in Alternative 3a. Operation and management costs for both Alternatives 3a and 3b reflect Operable Unit Three monitoring obligations only. U.S. EPA notes that proper management of a waste disposal facility is to include groundwater monitoring to check for releases from such facility. U.S. EPA further notes that design for both Alternatives 3a and 3b should likely consider whether monitoring wells associated with Operable Units One and Two might be able to play a role in Operable Unit Three. U.S. EPA also notes that the coming on line of construction planned for Operable Units One and Two may bring about a situation where sediment quality may improve, such that sediment excavation may be of minimal volume. U.S. EPA will monitor this situation, and observes that biological monitoring may be a useful measure. Any excavationnecessary in the vicinity of Little Bear Creek is expected to involve only light remedial activity.

Alternative 4 - Excavation of contaminated soils/sediments, monitoring, transport to an off-site landfill, placement of clean fill at the Ott/Story/Cordova site

Capital Cost: $ 4,500,000
Annual O & M Costs: $ 10,000
Net Present Worth: $ 4,600,000
Time to Implement: 8-10 months

As with alternatives 3a and 3b, contaminated soils and sediments will be excavated but sent off site for disposal in an existing landfill. The off-site landfill selected must be compatible with receipt of such waste material. Any off-site shipment of contaminated hazardous soils/sediments must consider rules which discuss shipment to treatment, storage, or disposal facilities, appropriate site security measures, inspection, etc. Some further analysis required by the receiving facility may be appropriate before materials are accepted for disposal.

Alternative 5 - Excavation of contaminated soils/sediments, monitoring, transport to an off-site incineration facility, treatment therein, disposal of residue in an off-site facility, placement of clean fill

Capital Cost: $ 18,600,000
Annual O & M Costs: $ 10,000
Net Present Worth: $ 18,800,000
Time to Implement: 12-14 months

In this alternative, the contaminated soils/sediments would be excavated and transported to an off-site incinerator where the waste materials would undergo thermal treatment. Conventional incineration is typically performed in the temperature range of 1600-2200 F. There may be more than one combustion unit. Residuals consist of ash, stack gases, scrubber/quench solutions. There are three basic types of incinerators; a fluidized bed model, rotary kiln, or infrared type. A fluidized bed type may eliminate some/all scrubber water compared to the rotary kiln or infrared models, since the fluidized bed type typically uses limestone internally to help control emissions. This model also operates at a somewhat lower temperature than the other two types. A screening step after excavation is important to eliminate large diameter objects from entering the device. Some metals can lead to troublesome emission control problems, that is, metals that can volatilize at temperatures below 2000 F., such as arsenic, mercury, and lead. This alternative may require test burns by the proposed treatment facility. Once materials undergo treatment, the residuals will require final disposal. The goal of conventional incineration is to convert organic contaminants to harmless by-products.

Alternative 6 - Excavation of contaminated soils/sediments, treatment on site by means of low temperature thermal desorption, monitoring, replacement of clean fill and/or transport of residue to off-site facility, land-usage restriction as appropriate

Capital Cost: $ 6,800,000
Annual O & M Costs: $ 10,000
Net O & M: $ 6,900,000
Time to Implement: 13-19 months

This alternative would utilize the technique of low temperature thermal desorption (LTTD) for on-site treatment of contaminated soils/sediments. To differentiate this treatment technique from conventional incineration, LTTD has as its objective the driving off of contaminants from the waste mass, rather than the destruction of such contaminants. There is no combustion in the primary unit of the waste itself; instead some portion of the organic contaminants are volatilized and then undergo further treatment, such as through an afterburner, condenser, or sorption unit. In LTTD application, materials are heated in three basic ways: direct heat, indirect heat, or in -situ steam extraction. Direct heat application is rather like an 800 F.rotary kiln; such application is most often used for non-chlorinated organics handling. Indirect heat may heat a fluid such as oil first, and pass the heated fluid through some jacket to heat the waste material. In- situ steam extraction involves working temperatures of around 300-450 F. In LTTD, the temperature 600 F. is seen as something of a "breakpoint". Below this temperature, it is assumed that the main application is for volatiles; from 600-1150 F., semivolatiles and PCBs are being attacked, also. 1150 F. is about the upper range for LTTD application. At these lower temperatures, metals such as lead do not volatilize, making an easier emissions control situation. After treatment, the residuals are soils, not ash. Unfavorable site characteristics include excessive clay/silt content in the soil, many large diameter rocks, excessive moisture

content - since energy is wasted driving off water first. LTTD is best applied when the organic contaminants do not make up more than 10% of the soil matrix. After treatment, dust generation may become a problem, so water is added to dampen the treated material. To prevent combustion, sometimes an inert gas such as nitrogen is injected countercurrent to the flow of treated material. Following treatment the residual soils may be suitable for replacement on site. Prior to commencing operation, treatability study would be necessary to define optimum operating conditions.

Alternative 7 - Construction of an on-site landfill with subsequent excavation of and disposal of a substantial portion of contaminated soils/sediments therein, excavation and off-site treatment of more highly contaminated soils/sediments, capping, monitoring, restriction of further land usage, security measures, maintenance, clean fill

Capital Cost: $ 4,113,000 (if 100 cubic yards treated)
Capital Cost: $ 6,480,000 (if 1200 cubic yards treated)
Annual O & M Costs: $ 50,000
Net Present Worth: $ $ 4,882,000 to $ 7,249,000
Time to Implement: 23-28 months

This alternative combines the usage of containment to deal with the majority of contaminated soils/sediments with treatment of that lesser volume containing more contaminated materials. From RI sampling, and supplemental sampling to obtain TCLP, dioxin, toxicity, and excavation analysis results, two site areas appear to have been more highly contaminated. These are: 1) The areas around 1992 sampling area test pits 4 and 5 because of their concentrations of such mobile and toxic compounds as carbon tetrachloride, 1,2dichloroethane, chloroform, etc.; and 2) Surface soils identified as dioxincontaminated near the former incinerator pad area. The volume of soils associated with these areas of greater soil contamination is estimated at from 100 cubic yards for the incinerator area to 1200 cubic yards for areas near test pits # 4 & 5. For the purpose of cost estimation of this alternative, it is assumed that the treatment of such higher contamination areas will be performed off site by conventional incineration.

Common Elements: Except for the "No-Action" alternative, other alternatives noted have certain elements in common. Alternatives which would leave contaminated soils or fill on the Ott/Story/Cordova site all envision some form of land-usage restriction. In alternatives 3a, 3b and 7, the key objective of restricting land usage is so that the newly created on-site landfill is not unduly disturbed. This is in addition to an objective of alternative 2, where land usage restriction through enhanced security or deed restriction has as a goal the reduction of exposure to otherwise contaminated soil areas. Monitoring is a component of alternatives 3 through 7. In all cases, monitoring implies sampling of soils/sediments areas undergoing remediation to ensure that desired cleanup criteria have been attained. In alternatives 3a, 3b and 7, monitoring also implies periodic examination of the integrity of the landfillcover, while in alternatives 5 and 6 monitoring further means checking soil/sediment condition after treatment. Appropriate monitoring of such units often involves placement and sampling of groundwater monitoring wells as a means of checking for effectiveness. (In this instance remedial design may show that placement of such wells may not be required because the execution of Operable Units One and Two requires the development of an appropriate groundwater monitoring network which may prove to be sufficient for such purpose.) Operation and maintenance might normally require consideration of installation of facilities a means of treating liquids/leachate that may be gathered from the fill area. However, U.S. EPA makes the assumption at this time that any liquids so gathered from an on-site landfill will be compatible with the contaminated groundwater treatment works necessary for Operable Units One and Two.

Excavation of affected areas is also a common component of alternatives 3 through 7. With regard to excavation, it should be noted that excavation of contaminated soils near former production areas may involve relatively heavy earth-moving equipment, whereas any excavation of any contaminated sediments in the vicinity of the creeks would involve small volumes and light manual equipment. U.S. EPA observes that the principal identifiable hazardous substances associated with deposits along the stream banks are volatile organic materials such as benzene and toluene. U.S. EPA will be guided by monitoring and observation to be conducted as a part of Operable Units One and Two to changes in sediment condition, and the necessity to actively perform light remediation activity along the stream banks. Another common element of alternatives 3 through 7 is the amount of soil/sediment to be excavated. This volume is estimated at 7200 cubic yards, and is derived from calculations performed to attain Michigan Act 307 Type B criteria, which U.S. EPA believes is an appropriate Act 307 application in this instance. 8. Summary of Comparative Analysis of Alternatives

A. The Nine Evaluation Criteria

In selecting its preferred remedial alternative, U.S. EPA uses the following criteria to evaluate each of the cleanup alternatives developed in the FS and its supplement. The nine evaluation criteria are summarized below:

1) Overall protection of human health and the environment addresses whether or not an alternative provides adequate protection of human health and the environment and describes how risks are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2) Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) addresses whether or not an alternative will meet all of the ARARs pertaining to federal and state environmental laws and regulations and/or justifies the invoking of a waiver of such ARARs.

3) Long-term Effectiveness and Permanence refers to the expected residual risk and the ability of an alternative to maintain reliable protection of human health and the environment over time, once cleanup objectives have been met.

4) Reduction of Toxicity, Mobility, or Volume through treatment is the anticipated performance of the treatment technologies an alternative may employ.

5) Short-term Effectiveness involves the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup objectives are achieved.

6) Implementability is the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement the given option.

7) Cost includes estimated capital costs, as well as operation and maintenance costs. A present net worth cost is then calculated from these costs.

8) State Acceptance indicates aspects of the preferred alternative and other alternatives that the state support agency (MDNR) favors or objects to, and comments regarding state ARARs or the proposed use of waivers.

9) Community Acceptance indicates the public support of a given alternative. This criterion is discussed in the Responsiveness Summary.

B. Comparative Analysis

Overall protection of human health and the environment - The "noaction" alternative does not offer adequate protection of human health and the environment. Taking no action would allow the unabated presence of a level of risk beyond that deemed acceptable.

Additionally, as biological testing performed on site soils has indicated, harm to the environment may result if certain site areas do not undergo remediation. Alternative 2, which relies solely on institutional control as a means of remedy, is not protective of human health and the environment. Even if measures limiting site access and deed restrictions were rigorously observed, areas of the site would still pose possible problems. While site manufacturing activity has been curtailed, a "skeleton" staff still remains. The site gets visitors from time to time from persons interested in surplus chemical equipment. Furthermore, actions taken to restrict access by persons would not provide sufficient environmental protection to those site areas which appear to have some inhibitory effect upon plant life and soil bacteria. Such restrictions also would do nothing to mitigate further release of hazardous substances into groundwater. Therefore, while some manner of institutional control may have a role to play in site remediation, such control in itself does not provide adequate protection. Furthermore, the NCP at 40 CFR 300.430(a)(1)(iii)(g) indicates that the use of institutional controls is generally onlyappropriate as supplemental to active remediation, such as treatment or containment, unless such active remedies are not practicable, which they are in this case.

All other alternatives are viewed as protective of human health and the environment because they will remove contaminated soils and leave behind concentrations attaining soil cleanup criteria. Since the "no action" alternative and the alternative relying solely on institutional control (Alternatives 1 and 2) are not protective of human health and the environment, they will not be considered further in this document.

Compliance with ARARs - The primary ARARs for Operable Unit Three include federal and state regulations dealing with soil cleanup criteria, waste management and landfill cover and liner construction, proper management of fugitive dusts created through excavation, management of leachate generated and collected, soil erosion protection measures, proper shipment and waste characterization steps, control of air emissions generated, and restriction of inappropriate materials from being disposed. TCLP testing conducted by U.S. EPA indicated that the soils/sediments to undergo disposal are not characteristically hazardous with regard to such compounds as methoxychlor, hexachlorobenzene, and 1,4-dichlorobenzene. The significance of such testing was that at the time of release of the proposed plan to the public concerning possible remedial action for Operable Unit Three that U.S. EPA did not advocate a landfill design which would attain the even more restrictive specifications which may be found in RCRA Subtitle C or Michigan Act 64 which deal with management of hazardous wastes. The Landfill Disposal Restrictions noted in 40 CFR Part 268 were therefore not relevant and appropriate with regard to these compounds. Another key ARAR for this and all other alternatives discussed is to minimize the creation of fugitive dusts that may be created during the excavation and/or transportation phases of the remedial action. Parts 3, 7, and 9 of Michigan Act 348 (Air Pollution Act) discuss the limitation of particulates, fugitive dusts, and volatile organics which may result from construction and excavation activity performed to implement a given remedy. Any collection and subsequent routing of leachate or other water generated by undertaking action for Operable Unit Three would be subject to provisions of the Clean Water Act of 1977, as amended, dealing with the discharge of specific compounds into navigable waters. At this time, U.S. EPA makes the presumption that any leachate or other water generated and collected on-site would be compatible with and would be routed to the treatment system to be built to serve Operable Units One and Two. The substantive requirements of Michigan Act 347, dealing with soil erosion and sedimentation, may also apply to acts of remediation. It would be appropriate in the undertaking of Alternatives 3a through 7 to take representative samples of soils handled or shipped with frequency sufficient to adequately develop information on how the soils should be treated, stored, or disposed. Alternatives 3a through 7 should comply with all of the major ARARs noted above provided due care is taken in the construction and maintenance phases of the work to be done. Given the numerous instances of discarding specific chemicals on the site, it would appear that for Alternative 4 a compatible landfill for disposal of untreated contaminated soils must comply with RCRA Subtitle C design standards. U.S. EPA notes that the greatest burden of compliance with air emission regulations would appear to fall on Alternative 6, since that alternative contemplates on-site treatment.

It is noted for purposes of ARARs discussion that the State of Michigan has promulgated rules pursuant to the Michigan Environmental Response Act, Act 307. This state statute was originally enacted in 1982, but underwent significant amendment in 1990. The State of Michigan issued rules reflecting such amendment in July 1990. In general, U.S. EPA maintains that substantive provisions of state regulations which are more stringent than CERCLA requirements constitute ARARs. Act 307 consists of eight parts, but of particular note are parts 6 and 7 which deal with remedial action and cleanup criteria, respectively. U.S. EPA notes that upon examination of these parts, certain administrative provisions are very similar to the nine criteria which form the basis for remedial decisions under the NCP. Such administrative provisions are not ARARs. However, the substantive provisions of these parts are considered ARARs for this response action.

Rule 705(2) and (3) require that all remedial actions shall attain the degree of cleanup for a Type A, B or C remedy, or a combination thereof. U.S. EPA believes such cleanup selection to constitute an ARAR. A Type A cleanup generally achieves cleanup to background levels. A Type B cleanup generally achieves specific standard risk-based cleanup levels. A Type C cleanup is based on a site-specific risk assessment that considers specific criteria. Also, Type A cleanup is to attain the standards noted in Rule 707. Type B cleanup must reflect attainment of Rules 709-715 and Rule 723. Rule 717 discusses Type C cleanup. U.S. EPA notes that it has consulted with the MDNR concerning the soils cleanup criteria noted elsewhere in this document.

Under the NCP, U.S. EPA is responsible for determining how Act 307 applies to the site. U.S. EPA has examined this matter and has determined that the attainment of Type B soil criteria is an appropriate application.

The following summary lists other ARARs of significance for this operable unit, as may they pertain to a given alternative:

- Clean Air Act and National Ambient Air Quality Standards (CAA and NAAQS), 40 CFR Part 50: These regulations discuss site emissions including particulates during on-site excavation. They provide methods and procedures for measuring specific airpollutants; such methodology may apply to operation of soil treatment systems. They are action-specific, regarding alternatives 3a through 7.

- Michigan Act 641 landfill regulations 299.4305(10), deal with appropriate landfill topsoil application and drainage/sloping requirements; 299.4308(1) deals with means of leachate collection; 299.4307(2)(a) deals with synthetic liner usage; 299.4307(2)(a) deals with thickness of clay liners; 299.4310 deals with appropriate vertical isolation from the bottom of the landfill to the top of the groundwater table.

- 40 C.F.R. Part 61; EPA Regulations on National Emission Standards for Hazardous Air Pollutants: These rules denote substances designated as hazardous air pollutants, prohibit certain activities and describe procedures involving construction and start of operations. These regulations may provide substantive requirements concerning operations. They are action-specific, regarding design of treatment for alternatives 5 through 7.

- Resource Conservation and Recovery Act (RCRA) of 1976, as amended by the Hazardous Solid Waste Amendments (HSWA) of 1984, 42 U.S.C. 6901. Subtitle C regulates disposal of that portion of solid waste designated as hazardous and the generation, transport, storage, treatment and disposal of hazardous wastes.

RCRA ARARs are not strictly applicable to this situation but are relevant and appropriate information, since RCRA wastes were known to have been managed here and waste chemicals were known to have been improperly land disposed on the site. RCRA ARARs may pertain to remedial action regarding alternatives 3a through 7, since residuals created require proper management.

- Michigan Air Pollution Act, Public Act 348 of 1965, as amended: This act regulates air quality in the presence of new or modified air sources. Parts 3, 7, and 9 of this regulation discuss emissions and limitations for particulates, fugitive dust, volatile organic compounds, and other contaminants which may be injurious or adversely affect human health or welfare, animal life, vegetation, property, or interfere with normal use and enjoyment. Substantive portions of this regulation may apply to excavation of contaminated soils, operation of any soil treatment system, and related construction activity. This act is action-specific, regarding monitoring or any needed control of volatile organics in alternatives 3a through 7.

- 40 C.F.R. 262; Regulations for Hazardous Waste Generators and Michigan Hazardous Waste Management Rules, Part 3, R299.9301 to 9309; "Generators of Hazardous Wastes."

Note: This, as well as the CERCLA off-site policy, is "to be considered" information which may pertain to any necessary off-site shipments of still-contaminated soils after treatment by low temperature thermal desorption. Such regulations are ARAR if CERCLA site materials are shipped off site to RCRA treatment, storage or disposal (TSD) facility and constitute a hazardous waste. They are chemical-specific, as related to soils/sediments and as pertaining to alternatives 4 through 7.

40 C.F.R. 264, Subpart C; Preparedness and Prevention.

40 C.F.R. 241, concerning construction of a RCRA Subtitle D landfill for disposal of nonhazardous wastes. This is an action specific ARAR for alternatives 3a or 6.

40 C.F.R. 264.340-351, concerning incinerator performance standards. A potential ARAR if on-site incineration is selected.

40 C.F.R. 264 Subpart X. Describes substantive requirements for miscellaneous RCRA treatment units, such as low temperature thermal desorption. Pertinent to alternative 6.

- ! Michigan Hazardous Waste Management Rules.

Note: As with RCRA, these State rules constitute relevant and appropriate information, especially to the degree that they exceed their counterpart federal regulations in substantive requirements. They are potential ARARs for post-closure detection monitoring after remediation if hazardous wastes remain on-site. Actionspecific, for alternatives 2 through 7. (Design may indicate compliance is possible with portions of these rules through monitoring necessary to undertake surface water and groundwater restoration measures called for by Operable Units One and Two, respectively.) Should an Act 64-compliant landfill be selected, pertinent measures from Act 64 include regulations 299.9619(6) dealing with appropriate means of synthetic cap installation, topsoil placement, and drainage measures; 299.9619(1) and (2) dealing with synthetic and clay liners, respectively; 299.9619 (3) and (4) dealing with leak detection and leachate collection, respectively; and 299.9603(5) which discusses bottom layer thickness and permeability characteristics of soils which are to intervene between the landfill and the top of the groundwater table.

- ! Part 7, R336.1702; New Sources of VOC Emissions.

Note: This is an ARAR for new sources of VOC emissions for new remedial action. Any person responsible for any new source of VOC emissions shall not cause or allow the emission of VOC emissions from the new source to exceed the lowest maximum allowable emission rates. A design consideration for alternative 6 if treatment is performed on-site, since volatile organics are a component of some soils/sediments and transfer from soils to air without proper emission control is not appropriate.

- ! Michigan Environmental Response Act; Act No. 307

As discussed above.

Long-Term Effectiveness and Permanence - Through on-site or offsite containment measures, Alternatives 3a, 3b, 4, and 7 would provide effectiveness and permanence by reducing human exposure via ingestion or direct contact to contaminated materials, and by reducing the amount of water infiltration through such materials thereby aiding in the reduction of amounts of contaminants that may be introduced to the groundwater below the site. For on-site alternatives, long-term maintenance would be required, and portions of the cap may need repair in the future. Alternative 4 calls for off-site landfill usage. U.S. EPA notes that under CERCLA, off-site disposal without treatment is considered a least preferred option for alternatives that otherwise offer adequate protection and comply with ARARs. Alternatives 5, 6 and 7 may offer a superior degree of attainment of this criterion in that they call for the destruction or capture of the highest concentrations of the contaminants. While employment of either a containment or treatment remedy could result in attainment of appropriate criteria concerning degree of risk remaining in soils to which site users could be exposed, a treatment remedy offers less uncertainty and greater permanence in the continuing attainment of cleanup criteria than either institutional control or containment remedies. This, in the case of the Alternatives 5, 6 and 7 is accomplished either through the direct destruction of hazardous substances or the driving off and subsequent destruction of such compounds. U.S. EPA notes that site remedies previously selected call for the capture of the groundwater contamination. The excavation and subsequent treatment/disposal of contaminated materials will reduce the ability of such materials to act as a future source of groundwater contamination. An alternative featuring such source reduction capability is therefore compatible with remedies previously selected.

Reduction of Toxicity, Mobility, or Volume of the Contaminants through Treatment - Alternative 5, conventional incineration, offers the highest degree of attainment of this criterion in that the entire mass of contaminated soil would be subjected to intense thermal treatment. Alternatives 6 and 7 (LTTD and treatment of certain more highly contaminated soil areas) also attain this criterion, although to a lesser degree. Although in Alternative 6 the entire waste mass is to be treated, the intensity of treatment is not as rigorous as in Alternative 5. Treatment addresses principal threats posed at the site, in that employment of a technique such as LTTD is expected to result in significant removal and subsequent destruction of site soil contaminants such as aniline compounds, 4,4'- DDT, PCBs, carbon tetrachloride, etc. Benefits of LTTD employment as compared to conventional incineration are less risk of generation of metallic compound emissions, and less risk of generation of products of incomplete combustion, since there is no direct combustion of the waste mass itself. Selection of LTTD at other sites indicates that this technology would appear to have practicable application.

Alternatives 3a and 3b, on-site landfilling and capping, and Alternative 4, off-site landfilling, do not provide for reduction of toxicity, mobility, or volume through treatment.

Short-Term Effectiveness - Alternatives 3a through 7 all have the potential for exposure during excavation and construction, transport, or treatment phases. Instituting proper health and safety and emission control procedures will aid in minimizing such risk. One possible advantage of Alternatives 3a, 3b, 6, and 7 when compared to Alternatives 4 and 5 is that they call for onsite handling of all or most contaminated soils and sediments. Therefore, there is no risk of exposure during transportation. The on-site treatment that Alternative 6 envisions may require a more rigorous means of emissions control than Alternatives 3a or 3b, such as employment of flaring, condensation, or carbon adsorption techniques for contaminants driven off the soil mass.

Implementability - Alternatives 3a through 7 are all considered to be implementable. Landfill capping techniques and construction or usage are well established. U.S. EPA notes that Alternatives 4 and 5 rely to a large degree on presumed existing disposal and treatment capacity, respectively. It is also presumed that vendor developed mobile equipment would be utilized for Alternative 6. Therefore, remedial design efforts in implementing Alternatives 4, 5 and 6 may be less rigorous than for other alternatives such as 3a or 3b. Techniques involving on- or off-site treatment should also be implementable from a technical standpoint; however U.S. EPA cannot predict with certainty as to what degree vendor services and capacity at the time treatment is needed will be available. Alternative 6 may require further information to be derived from pre-design work prior to implementation. Such information may focus on whether all soils thus treated should be heated to a common temperature, or whether a portion thereof would be more effectively treated at a higher temperature. Design for Alternative 6 also considers what proportion of emissions thus created from driving contaminants off the soils should be performed by flaring, condensation, or usage of carbon adsorption. These emission control techniques are considered reliable, and necessary monitoring can be performed for each.

Cost - The present worths of Alternatives 3a, 3b, 4, 5, 6, and 7 were estimated as: (3a) $ 4,700,000; (3b) $ 5,400,000 to $ 11,200,000; (4) $4,600,000; (5) $ 18,800,000; (6) $ 6,900,000; and (7) $ 7,249,000, at the time of issue of the proposed plan to the public. Based on review of commentary received, U.S. EPA now believes that the upper-most cost range for Alternative 3b ($ 11,200,000) is more truly indicative of the cost for on-site containment without prior treatment, and that the present worth of Alternative 6 is revised to an estimated $ 6,808,000 as discussed in the Documentation of Significant Changes section of this decision record. Hence, the selected alternative, Alternative 6, is far less costly than either conventional incineration or Alternative 3b, which features containment only in an on-site landfill taking into account the possibility of risk underestimation in managing the contaminated soils. One possible uncertainty in predicting cost of any alternative is with the volume of soil to be managed. With regard to Alternative 6, it should be noted that U.S. EPA has utilized a cost per cubic yard basis at the high end of an expected spectrum of costs. As is noted in U.S. EPA's Responsiveness Summary, U.S. EPA has utilized an estimate of $ 340 per cubic yard for LTTD treatment. The literature and vendor information suggest a range of from $ 45 to $ 350 per cubic yard. Variance in these figures is attributed to contract terms, soil moisture content, type of organic contaminant to be dealt with, and degree of treatment efficiency sought.

State Acceptance - The MDNR has indicated a decided preference for low temperature thermal desorption treatment of the contaminated soils. The MDNR has also indicated that if containment of such soils without prior treatment were contemplated, an Act 64 type of landfill with full vertical isolation measures incorporated would be preferable to an on-site Act 641 landfill.

Community Acceptance - Community acceptance of the preferred alternative has been evaluated after the close of the public comment period and is described in the Responsiveness Summary portion of the ROD. The public responded negatively to the creation of landfills in the Muskegon area. The public's reaction to the suggestion of the possibility of combined response action at Muskegon area CERCLA sites was mixed; the public did not advocate combined response action involving the Ott/Story/Cordova and Bofors sites, but did advocate combined response action between the Ott/Story/Cordova and Duell & Gardner sites especially in the area of contaminated soils. It should be noted that the Duell & Gardner proposed plan called for dealing with portions of contaminated soils at that site through usage of low temperature thermal desorption treatment followed by management of residuals and site closure through placement of an Act 641-compliant cover over that site. The public sent 10 letters to U.S. EPA urging that some manner of treatment technology be utilized, as opposed to landfill utilization.

9. Documentation of Significant Changes

U.S. EPA has reviewed and responded to all significant comments received from interested parties during the public comment period. Comments were made on the alternative indicated as preferred in the Proposed Plan as well as other alternatives. Based on review of these comments, the U.S. EPA has determined that there should be a significant change made in the alternative selected. At the time of the release of U.S. EPA's Proposed Plan to the public, U.S. EPA indicated that Alternative 3a was the preferred alternative. This alternative includes construction of an on-site landfill with subsequent excavation and disposal of contaminated soils/sediments therein, capping, monitoring, restriction of further land usage, security measures, maintenance, clean fill placement. After evaluation of the comments received, and a review of the alternatives using the nine evaluation criteria, U.S. EPA now has a preference for Alternative 6, as set forth in the Proposed Plan, with slight modifications thereto. Alternative 6 involves excavation of contaminated soils/sediments, treatment on site by means of low temperature thermal desorption, monitoring, usage of treated soils which successfully attain soil cleanup criteria as on-site backfill material, and transport of residue not attaining soil cleanup criteria to an appropriate off-site facility, with imposition of land-usage restrictions as appropriate.

Compared to either Alternative 3a or 3b, Alternative 6 provides a shorter estimated implementation time, provides for superior reduction of toxicity, mobility, or volume of hazardous substances, provides for a superior degree of long-term effectiveness and permanence, and appears to be far more cost-effective than Alternative 3b. Alternative 6 provides superior short-term effectiveness in that the amount of time necessary to complete the remedial design is less than Alternative 3a or 3b. There is also a higher degree of state and community acceptance of LTTD treatment as opposed to construction of a landfill.

U.S. EPA makes note of certain public comments received which argued that untreated contaminated soils should be disposed of within a landfill structure attaining the more rigorous Michigan Act 64 criteria, due to the presence of tentatively identified compounds within the soils. These tentatively identified compounds appeared to include substances which are used as a herbicide, pesticide, or which have a chemical structure featuring the cyanide grouping. Some commentary suggest that certain site soils may be characteristically hazardous. Discarded chemicals were known to have been improperly land disposed on the property. Since relevant and appropriate criteria associated with the construction of an Act 64 compliant landfill call for, among other measures, a 20 foot thick layer of compacted clay beneath the landfill and above the groundwater table, the cost of appropriate on-site landfill construction is at the high end, i.e., $ 10-11 million, of U.S. EPA's estimate forconstruction of such an on-site hazardous waste landfill. While U.S. EPA may elect to waive a given ARAR, it may not be appropriate to do so in this instance because of the relatively high groundwater table at the Ott/Story/Cordova site.

As noted in the supplement to the FS and the proposed plan, it was assumed that soils which did not achieve soil cleanup criteria after initial treatment by low temperature thermal desorption (LTTD) would undergo more rigorous treatment through incineration in an effort to achieve cleanup criteria. Hence, capital costs for the LTTD alternative in the proposed plan include costs for treatment by incineration for the 25% of contaminated soil volume which was estimated not to attain soil cleanup criteria after LTTD treatment. The supplement to the FS estimates off-site incineration costs as $ 2,952,000. Comment received by the State of Michigan indicates that application of LTTD technology should provide an acceptable degree of treatment such that soil residuals not attaining soil cleanup criteria will have attained a sufficient degree of treatment such that placement in an Act 641 compliant landfill would be acceptable. This comment appears to be supported by treatability information which appears in the Ott/Story/Cordova record which was obtained from studies performed at the Anderson and Duell & Gardner sites. In both those instances, LTTD application resulted in 90-99% removal of organic compounds. The 99% removal rate was achieved at the Duell & Gardner site. Because of the similarity of soil characteristics between the Duell & Gardner and Ott/Story/Cordova sites (the sites are both located in Dalton Township, only a few miles apart), U.S. EPA has reason to believe similar removal efficiencies could be realized through LTTD application at the Ott/Story/Cordova site. In removing contaminants with this degree of efficiency, U.S. EPA concurs with the State's assertion that subsequent management after LTTD application could be conducted in accordance with solid waste, rather than hazardous waste, regulations. Deleting the incineration cost, and adding in a disposal fee of approximately $ 25/cubic yard for usage of a commercially available Act 641 compliant landfill results in revised cost estimates for the LTTD alternative as shown:

	Previous Estimate	Revised Estimate
option subtotal	$ 7,575,950	$ 4,683,950
+bid contingency (8%)	606,075	374,716
+scope contingency (15%)	1,136,390	702,592
construction cost	9,318,415	5,761,259
+permit/legal (5%)	465,920	288,063
+construction service (5%)	465,920	288,063
implementation costs	10,250,255	6,337,385
+design costs	512,515	316,869
total capital costs	10,762,770	6,654,254
+O & M costs	154,000	154,000
present net worth	10,919,800	6,808,254

As noted in the proposed plan, were an on-site landfill to be built so as to fully comply with all aspects of Michigan Act 64, capital costs would be approximately $ 10,400,000. Allowing for operation and maintenance costs present worth would total approximately $ 11,200,000. Hence, assuming that more intensive treatment of those soils which do not fully attain soil cleanup criteria is unnecessary, LTTD treatment followed by usage of a less rigorous landfilling option would appear to be a distinctly more costeffective form of remediation as opposed to disposal in a more rigorously designed on-site landfill. Upon review of comments received, and in light of the existence of TICs and the observations made during test pit excavation, U.S. EPA concludes that untreated contaminated soils, if landfilled on site, should be put in a hazardous waste landfill. After considering LTTD results at the Anderson and Duell & Gardner sites, U.S. EPA has reason to believe that a significant amount of contaminated soils will attain soil cleanup criteria after LTTD treatment at the Ott/Story/Cordova site such that designing an on-site landfill for this lesser volume would be impractical and not cost effective. Because of the high level of removal efficiency realized in LTTD testing at the Duell & Gardner site, and the proximity of that site as well as its similar soil and contaminant characteristics to the Ott/Story/Cordova site, U.S. EPA presumes that, after LTTD treatment, soils not fully attaining soil cleanup criteria can be managed off-site in an Act 641 (nonhazardous) landfill.

In the event that additional data or information during the design of the remedy reveals the need for modification, U.S. EPA will notify the public of any changes to the remedy presented in this ROD in accordance with applicable law and Agency guidance.

10. Selected Remedy

The selected alternative for the third Operable Unit is Alternative 6. Alternative 6 involves excavation of contaminated soils/sediments, treatment on site by means of low temperature thermal desorption, monitoring, usage of treated soils which successfully attain soil cleanup criteria as on-site fill material, and transport of residue not attaining soil cleanup criteria to an appropriate off-site facility, with imposition of land-usage restrictions as appropriate.

Alternative 6 provides a high degree of long-term effectiveness and permanence and is compatible with remedies previously selected.

Based on the current information, this alternative would appear to provide the best balance or trade off among the alternatives with respect to the nine criteria that U.S. EPA uses to evaluate alternatives.

The selected alternative would be protective of human health and the environment, and would comply with all ARARs. The goal of Operable Unit Three is to bring about the disposal and treatment of those soils and sediments which pose unacceptable risks to human health and the environment. The selected remedy utilizes permanent solutions and alternative treatment technologies, not solely because of the need to provide treatment of a principal threat involving risk to human health or the environment, but rather because usage of treatment techniques in this instance appears to result in selection of a more cost-effective remedy rather than usage of containment measures only. Due to certain characteristics of this site, specifically the high groundwater table and the possibility for underestimation of risk, selection of a treatment technique to manage most of the contaminated soils/sediments appears warranted.

Some changes to this alternative may result due to normal remedial design and construction processes. For example, items which are physically incompatible with the LTTD process, such as the introduction of excessively large drum fragments, discarded lab bottles, or potential highly concentrated waste forms - as opposed to contaminated soils - should likely be placed in overpack containers and subsequently managed in accordance with pertinent waste regulations.

11. Statutory Determinations

Protection of Human Health and the Environment

The soils and sediments associated with the OTT/STORY/CORDOVA site have been degraded through the introduction of contaminants associated with former material or product usage activity at the site. At least a portion of the soils and sediments pose an unacceptable risk to potential site users, with excess cancer risks greater than 1 x 10[-4] for future site workers. The toxicity results of vegetative root elongation and Microtox testing performed on soil samples collected in areas of sparse vegetation when compared tobackground sample conditions also indicate that the site as it exists may pose an environmental risk.

The selected remedy protects human health and the environment with regard to contaminated soils. The excavation of these contaminated areas and the subsequent treatment/containment of such contaminated soil/sediments utilizing techniques of appropriate design will aid in reducing contaminant levels and assist in preventing exposure above acceptable levels. Monitoring and institutional controls will also promote the evaluation of effectiveness of remediation measures.

Implementation of the remedy will not pose unacceptable short-term risks or cross-media impacts. With regard to risk to human health, the selected remedy will reduce levels of risk to potential users of the soils/sediments such that levels of protection as called for through achievement of Michigan Act 307 Type B cleanup criteria are attained. With regard to protection of the environment, the selected remedy will eliminate undue toxicity to life forms now posed by soil conditions.

Chemical and biological monitoring so as to assure the attainment of soil/sediment cleanup criteria and toxicity reduction goals in the surface and near surface site soils will be a necessary part of ensuring the achievement of these goals.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

The selected remedy is required to fully comply with all federal and more stringent state ARARs unless a waiver is invoked. The selected remedy complies with all ARARs. With regard to soils and sediments, the selected remedy has as its goal the attainment of all soil cleanup criteria as determined by Michigan Act No. 307, and the attainment of all federal/state ARARs concerning the management and handling of waste materials.

The selected remedy therefore will be in conformance with CERCLA Section 121.

Cost Effectiveness

The selected remedy affords overall effectiveness proportionate to its cost. The remedy promotes the attainment of soil cleanup criteria. Alternative 6 is far less costly than either conventional incineration or Alternative 3b, which features containment only in an on-site landfill.

Utilization of Permanent Solutions and Alternative Treatment technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The remedy selected provides the best balance of tradeoffs among the alternatives considered with respect to the nine evaluation criteria. The selected remedy utilizes permanent solutions and alternative treatment technologies. The site poses unacceptable risks with regard to soils/sediments, and U.S. EPA perceives that the presence of numerous tentatively identified compounds as well as compounds for which no pertinent slope factors exist may have resulted in an underestimation of risk to human health. There appears to have been some demonstration of environmental risk as well. Given the number of tentatively identified compounds detected in site soils, the high groundwater table at the site, the likelihood that certain treatment techniques may be brought to bear on site soils at less cost than certain "containonly" options, it appears prudent to select a remedy featuring such treatment techniques for most contaminated site soils/sediments.

The MDNR has been consulted during development of the site FS, proposed plan, and participated in the public comment period. Community views were solicited during the public comment period. U.S. EPA attempted to keep the community informed of site developments via the local information repositories and by the local establishment of certain documents in the administrative record for this site prior to the commencement of the public comment period.

Preference for Treatment as a Principal Element

The alternative selected, Alternative 6, features treatment of contaminated soils as a principal element of the remedy utilizing the technique of low temperature thermal desorption.